Claims

1. An echo canceler for reducing echoes resulting from a far-end signal, the echo canceler comprising:

a recursive least squares lattice structure to receive and whiten the far-end signal; and

a ladder structure to receive time delays of the far-end signal and to receive and decorrelate a microphone signal with the time delays to provide an echo canceled signal.

2. The echo canceler of claim 1, wherein the recursive least squares lattice structure includes a QR decomposition based least-squares structure.

3. The echo canceler of claim 2, wherein the QR decomposition based least squares structure provides angle normalized a posteriori prediction errors to perform forward and backward linear prediction.

4. The echo canceler of claim 1, wherein the ladder structure is further to calculate a joint process estimation error.

5. A method for reducing echoes resulting from a far-end signal, the method comprising:

receiving a microphone signal including a near-end signal and echoes;

whitening the far-end signal to provide whitened time delays; and

decorrelating a microphone signal based on the whitened time delays of the far-end signal to provide an echo canceled signal.

6. The method of claim 5, wherein whitening the far-end signal is performed by a recursive least-squares lattice structure.

7. The method of claim 6, wherein the recursive least squares lattice structure includes a QR decomposition based least-squares structure.

8. The method of claim 7, wherein whitening the far-end signal further includes the QR decomposition based least squares structure providing angle normalized a posteriori prediction errors and performing forward and backward linear prediction.

9. The method of claim 5, wherein decorrelating the microphone signal is performed by a ladder structure.

10. The method of claim 9, wherein decorrelating the microphone signal further includes the ladder structure performing a joint process estimation error.

11. The method of claim 5, wherein whitening the far-end signal and decorrelating the microphone signal is performed by a recursive least-squares systolic array.

12. The method of claim 5, further comprising selecting a time window and wherein decorrelating the microphone signal is performed over the time window.

13. The method of claim 12, further comprising equally weighting data representing the microphone signal and received during the time window.

14. The method of claim 12, further comprising applying a weighting function to data representing the microphone signal and received during the time window.

15. The method of claim 14 wherein the weighting function is an exponential weighting function.

16. The method of claim 14, wherein the weighting function is sliding weighting function.

17. A method for reducing echoes resulting from a far-end signal, the method comprising:

receiving a microphone signal including a near-end signal and echoes;

a recursive least squares lattice structure whitening the far-end signal to provide time delays; and

a ladder structure receiving the time delays and decorrelating a microphone signal based on the time delays to provide an echo canceled signal.

18. The method of claim 17, wherein the recursive least squares lattice structure includes a QR decomposition based least-squares structure.

19. The method of claim 18, wherein whitening the far-end signal further includes the QR decomposition based least squares structure providing angle normalized a posteriori prediction errors and performing forward and backward linear prediction.

20. The method of claim 17, wherein decorrelating the microphone signal further includes the ladder structure performing a joint process estimation error.

21. The method of claim 17, further comprising selecting a time window and wherein decorrelating the microphone signal is performed over the time window.

22. The method of claim 21, further comprising equally weighting data representing the microphone signal and received during the time window.

23. The method of claim 21, further comprising applying a weighting function to data representing the microphone signal and received during the time window.

24. The method of claim 23, wherein the weighting function is an exponential weighting function.

25. The method of claim 23, wherein the weighting function is sliding weighting function.